



U.S. EPA Develops Criteria for Finding and Cleaning Up Properties Contaminated with Radioactive Wastes from the Kerr-McGee West Chicago Rare Earths Facility

West Chicago, Illinois

March 1993

Public Meeting --

Community members are encouraged to attend a public meeting to learn more about the U.S. Environmental Protection Agency's (U.S. EPA or the Agency) criteria for identifying and cleaning up properties that have been contaminated by radioactive materials from the now inactive Kerr-McGee factory. U.S. EPA will describe the criteria and answer any questions from the public during the meeting. See p. 8 of this fact sheet for more information.

Inside --

Background Information p. 2

U.S. EPA's Approach to Finding and Cleaning Up Properties p. 4

U.S. EPA's Criteria for the Discovery, Characterization, and Verification Phases p. 5

Upcoming Public Meeting p. 8

Information Sources p. 9

Introduction

U.S. EPA, in consultation with Illinois Department of Nuclear Safety (IDNS), has developed criteria for identifying and cleaning up radioactive contamination at properties in the West Chicago area. The properties were contaminated when radioactive materials from the Kerr-McGee factory were used as fill throughout West Chicago and unincorporated DuPage County.

These criteria will be used during upcoming surveys for radioactive contamination in the West Chicago area. During the surveys, all potentially contaminated properties will be tested for radioactivity. If radioactive contamination is found at levels above the criteria that U.S. EPA established, U.S. EPA plans to remove the contaminated soil from the property. The criteria also will be used to verify that contaminated properties have been cleaned up to levels that protect human health and the environment.

Numerous properties could be affected by contamination, including those that have previously been tested or partially cleaned up. Many different types of properties could be affected by contamination, including homes, institutional, commercial and municipal properties. U.S. EPA developed the criteria described in this fact sheet specifically for the Superfund removal actions that are planned at these properties. Superfund is a program administered by U.S. EPA that provides funding for the investigation and cleanup of hazardous wastes at priority sites throughout the United States.

Because the criteria will affect property owners and residents in the West Chicago area, the Agency wants to know what the public thinks of the criteria. U.S. EPA is interested in hearing about any relevant information that the public believes has been overlooked. U.S. EPA is holding a public meeting on March 15, 1993 to provide an opportunity for the public to ask questions and provide feedback to U.S. EPA (see the back of this fact sheet for details). U.S. EPA is preparing to finalize the criteria after March 29, 1993, but the Agency will review any information it receives concerning criteria for identifying and cleaning up radioactively contaminated areas before that date.

The purpose of this fact sheet is to inform the West Chicago community about the criteria, explain how they were developed, and provide information on where residents can obtain more information about U.S. EPA's activities in the West Chicago area. For further information on the criteria, interested citizens are encouraged to review the document "Action Criteria For Superfund Removal Actions, West Chicago, Illinois--Review Draft" in the information repository ("See Learn More About The Kerr-McGee Sites" on page 9).

Background Information

From 1931 to 1973, a thorium extraction facility operated at 783 Factory Street in West Chicago, Illinois (see "Kerr-McGee Rare Earths Facility" Figure 1). The facility extracted thorium, radium, and other non-radioactive elements from various ores and minerals. The facility remained open until 1973, when Kerr-McGee Chemical Corporation (Kerr-McGee), the present owners, ceased operations at the facility.

Between the 1930s and early 1950s, the material left over from processing operations, called "mill tailings," was used as fill at properties in West Chicago and unincorporated DuPage County. The fill was later discovered to be potentially hazardous due to its radioactivity (See Box on "Radiation"). In addition, some radioactive material contaminated sections of Kress Creek.

As a result of this contamination, U.S. EPA proposed four separate Kerr-McGee sites for the National Priorities List in 1984. The National Priorities List is a roster of uncontrolled hazardous waste sites eligible to receive cleanup assistance under the Superfund program. The sites were finalized on the list in 1990 and 1991. The four Superfund sites are Reed-Keppler Park, West Chicago's Sewage Treatment Plant, sections of properties along Kress Creek and the West Branch of the DuPage River and the Residential Areas site. The Kerr-McGee factory is not a federal Superfund site, but is being addressed by the Illinois Department of Nuclear Safety.

In 1984, Kerr-McGee and the City of West Chicago conducted a voluntary cleanup at a number of properties in West Chicago. Kerr-McGee and the City of West Chicago removed contaminated soil from the properties and placed it back at the Kerr-McGee factory property. U.S. EPA believes it is possible that more soil may need to be removed from some of these properties, and will re-survey some of these areas to ensure that human health and the environment are protected. U.S. EPA also believes there are other properties not yet identified that may need contaminated soil removed from them.

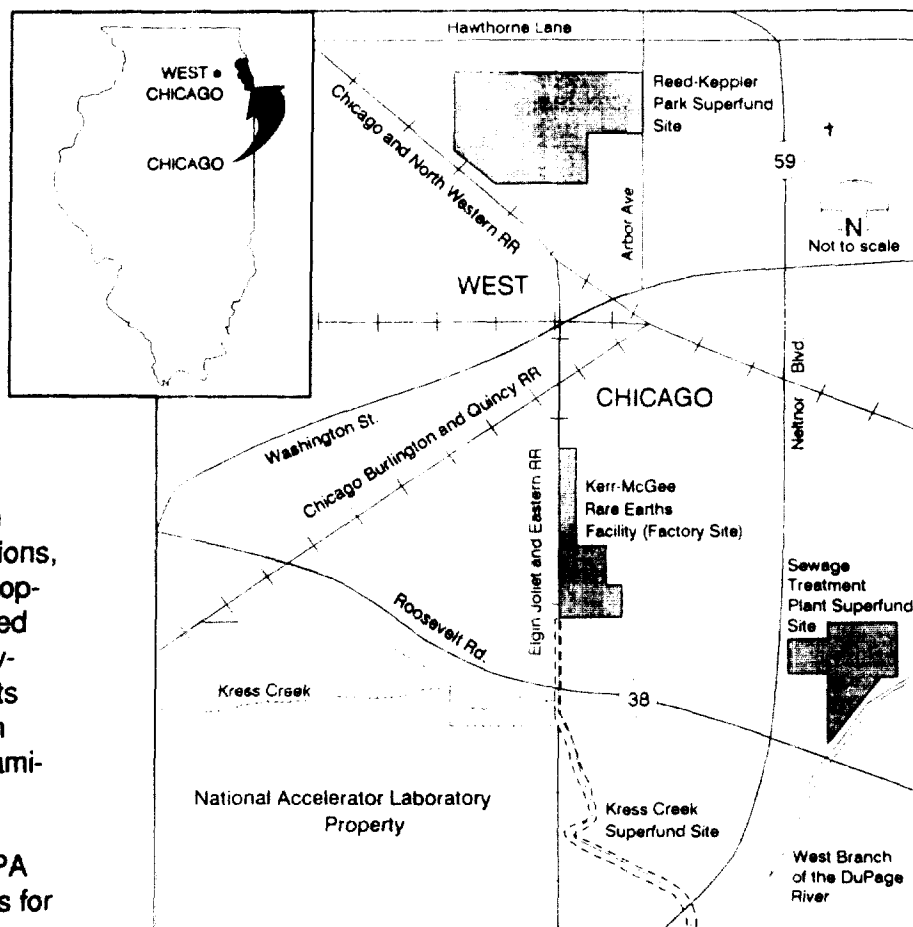
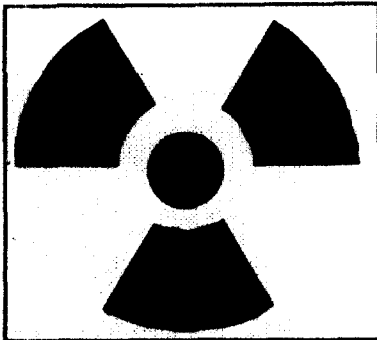


Figure 1



Radiation

"Radioactive" is a term used to describe elements, such as thorium and uranium, that are unstable and break down or "radioactively decay" over time, before eventually turning into stable elements. In the process of breaking down, other unstable radioactive elements, called "decay products," may be produced, and radiation given off. For example, radon is a radioactive gas produced during the decay of uranium materials. Thoron is a form of radon produced during the decay of thorium materials. Both radon and thoron are produced naturally; radon from natural uranium materials, and thoron from natural thorium materials.

There are three types of radiation produced in radioactive decay; gamma rays, alpha particles, and beta particles. Gamma rays are the most penetrating. They can pass through many feet of air and will pass through walls, clothing, and the body. Alpha particles penetrate very little and seldom pass through the dead cells on skin. Beta particles will penetrate to the upper skin layers but not to internal organs. Both alpha and beta particles present their greatest health hazard when ingested or inhaled.

When radioactive decay takes place, its rate or activity is an important quantity. For materials in West Chicago, measuring the activity in picocuries (pCi) is most appropriate. Normal radium in soil activities are about 1 picocurie per gram (pCi/g) of soil.

Radioactive decay can cause an exposure to humans. The unit for exposure is microrentgens per hour ($\mu\text{R/hr}$). Normal outdoor exposure is about 5 to 10 microrentgens per hour.

Exposure to radioactive materials can cause a radiation dose. The unit of dose most appropriate to West Chicago is the millirem. Normal dose is about 300 millirems (mrem) per year, with about 200 mrem coming from radon and about 100 mrem from other sources like the ground and cosmic rays.

Exposure to radiation can have many negative health effects on the human body. For West Chicago, U.S. EPA is most concerned about radiation's ability to cause cancer. Risks posed to property owners by contaminated materials may include an increased possibility of contracting cancer. U.S. EPA is currently evaluating the potential risks to property owners.

U.S. EPA's Approach for Finding and Cleaning Up Properties_____

U.S. EPA's approach for finding and cleaning up contaminated properties consists of three phases: 1) a discovery phase, 2) a characterization phase, and 3) a verification phase during and after cleanup. In each phase, U.S. EPA will survey properties for radioactivity by measuring: 1) outdoor gamma exposure rates, 2) the concentration of radioactive elements in soil, 3) indoor gamma exposure rates, and 4) the concentrations of radon and thoron decay products inside a home or other building. Each phase of U.S. EPA's approach is described in more detail below.

The Discovery and Characterization Phases

During the discovery phase, U.S. EPA will conduct an initial screening or "discovery" survey to determine whether a property is contaminated. If U.S. EPA needs more information, the property will move into the characterization phase, which is actually a more intensive discovery survey. During the discovery and characterization phases, U.S. EPA will survey all potentially contaminated properties in West Chicago and unincorporated DuPage County, including those that previously have been tested and/or cleaned up. It is quite possible that thousands of properties will be surveyed during this effort. The results of these two phases will determine whether properties are contaminated and, if so, to what extent.

Survey activities involve collecting soil samples, taking gamma measurements, and measuring radon and thoron. Gamma measurements will be collected by one or more field workers walking through yards and in and around buildings measuring gamma radiation with

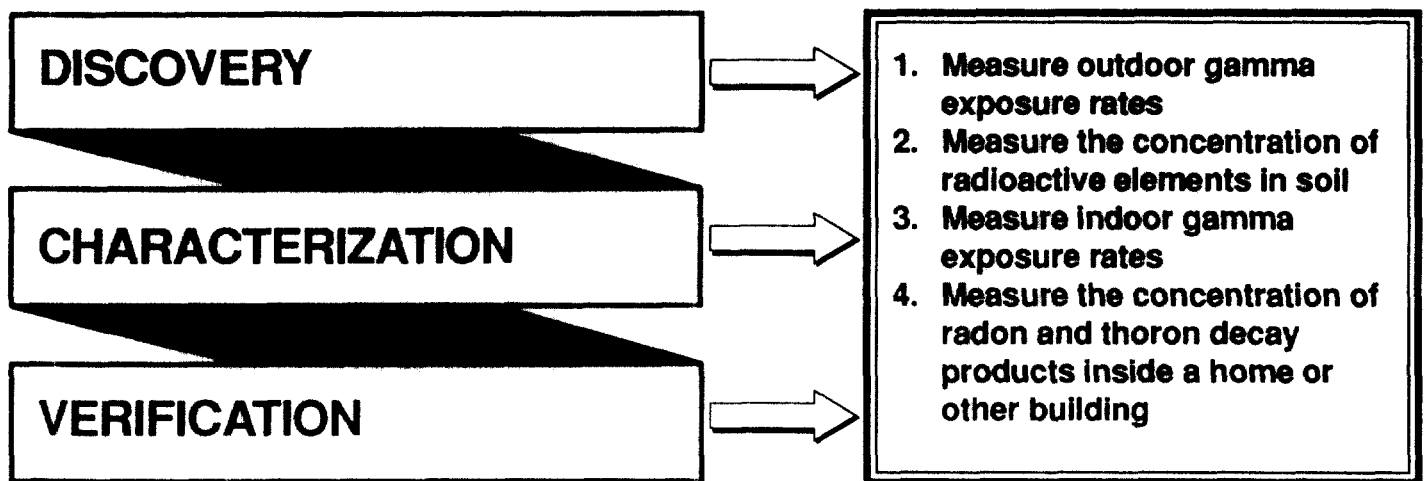
hand-held instruments. Soil samples will be sent to a laboratory for analysis to determine the concentrations of uranium and thorium and their decay products. Small canisters also will be placed inside buildings and collected at a later date to measure indoor concentrations of radon and thoron over a period of time.

U.S. EPA is expecting to begin the discovery phase of the project in Summer 1993. The discovery and characterization phases of the project are expected to take several years to complete because of the number of properties to be surveyed. For each property, U.S. EPA's survey may take several days.

Verification Phase

After U.S. EPA identifies a property as contaminated, the Agency will conduct a "removal action." A removal action includes digging up and removing contaminated soil, and replacing it with clean soil. As nearly as possible, each property will be returned to its original condition (except it will be minus the contamination). The verification phase is to confirm that contaminated properties have been cleaned up to levels that meet U.S. EPA's cleanup criteria.

During the verification phase, U.S. EPA will return to properties where contaminated soil has been removed, and collect soil samples and measure gamma radiation to determine if radioactivity is at or below the verification criteria U.S. EPA has developed. These measurements will be made before clean soil is brought in. U.S. EPA believes that basing the cleanup of contaminated properties on the following criteria will protect human health and the environment.



U.S. EPA's Criteria for the Discovery, Characterization and Verification Phases

For each phase, U.S. EPA has developed a criterion for each kind of radioactive contamination being measured or sampled. This section describes the purpose of the criteria, explains how they were developed, and describes each set of criteria for each phase of the project. Table 1 presents a summary of the criteria and explains how each is measured (see page 7).

The Purpose of the Criteria

The purpose of the criteria for the discovery and characterization phases is to determine which properties contain mill tailings from the Kerr-McGee Rare Earths Facility and require removal actions. If the radioactivity at a property exceeds the criteria and is due to mill tailings, the contaminated soil will be removed. U.S. EPA currently knows of approximately 35 properties that need removal actions. The number of properties needing removals is expected to grow as discovery surveys are conducted. Only properties that exceed the criteria for the discovery and characterization phases will have contaminated soils removed and replaced with clean soils. U.S. EPA also has established criteria for the verification phase to determine whether properties have been cleaned up to levels that protect human health and the environment.

How U.S. EPA Developed the Criteria

U.S. EPA's criteria are based on state and federal environmental regulations and standards. Under the Superfund law, U.S. EPA must clean up a site to levels that meet state and federal standards when they are "applicable or relevant and appropriate." These applicable or relevant and appropriate requirements, or ARARs, are the basis for U.S. EPA's criteria.

Applicable requirements are those cleanup standards or other requirements that would legally apply to the site even if the site was not a Superfund site. In the absence of applicable requirements, there may still be relevant and appropriate requirements that are designed to address problems, conditions, and situations similar to those that exist at the Superfund site.

U.S. EPA determined that there are no applicable requirements that apply directly to the conditions at contaminated properties in the West Chicago area. Therefore, U.S. EPA has developed the criteria based on ARARs that are relevant and appropriate to the site. U.S. EPA reviewed and studied federal and state environmental laws concerning uranium and thorium processing mills, and regulations for protecting the public and workers from radiation. U.S. EPA used the following sources for ARARs to develop its criteria:

- Title 40 of the Code of Federal Regulations (CFR), Part 192, titled "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," which contains standards for cleaning up specific facilities contaminated with uranium, thorium and radium;
- Title 32 of the Illinois Administrative Code, Part 332, titled "Licensing Requirements for Source Material Milling Facilities," which contains requirements for milling facilities, specifically the Kerr-McGee factory;
- Title 32 of the Illinois Administrative Code, Part 340 titled "Standards for Protection Against Radiation," which establishes standards for protecting workers and the public against radiation; and
- Title 10 CFR, Part 20, titled "Standards for Protection Against Radiation," which contains the Nuclear Regulatory Commission's standards for protection against radiation.

The Discovery Criteria

The discovery criteria will be used to survey properties for suspected contamination. U.S. EPA is using more and stricter criteria than Kerr-McGee used when the company cleaned up some properties in 1984. U.S. EPA also has made the discovery criteria slightly more strict than the criteria to be used during the verification phase. U.S. EPA's purpose in using stricter criteria for the discovery phase is to minimize the chance of not discovering properties where contamination actually is present. The discovery criteria are described on the next page.

The Discovery Criteria (continued)

Outdoor Gamma Exposure Rates

The criteria for outdoor gamma exposure rates is based on "Licensing Requirements for Source Material Milling Facilities" (Title 32, Part 332 of the Illinois Administrative Code). The State regulation requires that gamma exposure rates be reduced to "background levels" in the vicinity of milling facilities. Background is the level of naturally occurring radiation. Because the purpose of the standard is to limit public exposure to radioactive materials, U.S. EPA is using the background level as its criteria for outdoor gamma exposure rates. U.S. EPA will determine the background level by taking measurements of gamma exposure rates in an area of West Chicago that is free from contamination. U.S. EPA will compare these measurements with readings taken from potentially contaminated properties to determine if differences are statistically significant.

Outdoor Soil Concentrations

During the discovery phase, soil samples will be collected and analyzed in a laboratory for uranium, thorium and radium. U.S. EPA has established a criterion of 5 picoCuries per gram of dry soil above background for total radium (which includes radium from both the uranium and thorium decay series). U.S. EPA's criterion is based both on federal and state regulations (Title 32, Part 332 of the Illinois Administrative Code and 40 CFR, Part 192); however, because the Illinois regulation requires analysis of dry soil samples, this regulation is more strict than the federal regulation. As written, both regulations allow subsurface soils to contain up to 15 pCi/g. U.S. EPA evaluated this standard and determined that the 15 pCi/g limit was based on the ability of survey instruments to locate contamination beneath the ground. Furthermore, the 15 pCi/g limit is not strict enough to ensure that human health would be protected if a home is built over the contamination. Therefore, U.S. EPA is establishing the 5 pCi/g criteria for soil at any depth.

Indoor Gamma Exposure Rates

The criterion for indoor gamma exposure rates is the same as the outdoor criterion for gamma exposure rates: background. The criteria is based on the same ARAR, the "Licensing Requirements for Source Material Milling Facilities," (Title 32, Part 332, of the Illinois Administrative Code), which requires "...the direct gamma exposure rate from byproduct materials shall be reduced to background levels normal for areas in the vicinity." Although a federal regulation (40 CFR, Part 192) allows indoor levels of gamma radiation to be

higher than background, U.S. EPA has determined that it isn't appropriate at this site to allow higher readings indoors than outdoors. Therefore, to be protective of human health, U.S. EPA set the criteria to be the same as for outdoor gamma exposure rate.

Concentrations of Indoor Radon and Thoron Decay Products

The criterion for indoor radon and thoron decay product concentrations is based on "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings" (40 CFR, Part 192), which sets a range between .02 and .03 "working levels" as the standard. Working levels is a measure of the total energy given to lung tissue by alpha particles from radon or thoron decay products. It is closely associated with lung dose. In keeping with its approach to use stricter criteria in the discovery phase than in the verification phase, the Agency has selected .02 working levels for combined radon and thoron decay products as the criterion during discovery.

U.S. EPA will not determine that a property is contaminated based solely on this criterion. Both radon and thoron are naturally occurring to some extent, and naturally occurring levels could exceed the criterion. Superfund money cannot be used to clean up radioactive materials that are naturally occurring. Therefore, this criterion will be used in conjunction with all the other criteria to determine whether a property is contaminated with thorium mill tailings. If a home has elevated radon levels, but no other evidence can be found that contaminated wastes were placed on the property, then a removal action will not be conducted at the property.

Characterization Phase Criteria

The characterization phase will not be conducted at all properties. Rather, the characterization phase will take a closer look at properties where: 1) the initial measurements of radioactivity are close to the discovery criteria, or 2) it is not clear whether radioactivity is due to mill tailings or natural sources. The purpose of the characterization phase is the same as the discovery phase: to identify contaminated properties. Because the purpose is the same, the criteria are the same. The difference between the discovery phase and the characterization phase is the amount of surveying and sampling that will be conducted. Specifically, more soil samples will be collected and more readings of gamma exposure rates taken during the characterization phase.

For properties where it is not clear whether radioactivity is due to mill tailings or natural sources, data collected during the characterization phase will help determine the source of the radioactivity. As stated above, U.S. EPA cannot use Superfund money to clean up naturally occurring cases of radiation, such as high radon concentrations, but will inform property owners what they can do to help correct the problem, if it is encountered.

Verification Phase Criteria

The verification phase will take place during and after the removal of contaminated soil from a property. For the verification phase, U.S. EPA is using slightly different criteria than the criteria to be used in the discovery and characterization phases (See Table 1: Cleanup Criteria). Where the purpose of the discovery and characterization phases is to identify contaminated properties that need to be cleaned up, the purpose of the verification phase is to confirm that properties are cleaned up to levels that protect human health and the environment. The verification criteria are presented below. However, only those that differ significantly from the discovery phase criteria are described in detail.

Indoor and Outdoor Gamma Exposure Rates

The verification criteria for indoor and outdoor gamma exposure rates are the same as during the discovery and characterization phases.

Outdoor Soil Concentrations

The criterion to verify that contaminated soils have been removed is 5 pCi/g of dry soil above background for total radium. As allowed by the relevant and appropriate regulations, the Agency may combine the values of samples collected over 100 square meters and average them to obtain a single value to compare to the criteria. The criteria are based on both federal and state regulations: "Licensing Requirements for Source Material Milling Facilities" (Title 32, Part 332 of the Illinois Administrative Code) and "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings" (40 CFR, Part 192).

Concentrations of Indoor Radon and Thoron Decay Products

The verification criterion for indoor radon and thoron decay product concentrations is .03 working levels. The criteria are based on "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings (40 CFR, Part 192)," which establishes a standard between .02 and .03 working levels.

Table 1: Discovery, Characterization, and Verification Criteria

Listed below are the criteria U.S. EPA will use for the discovery, characterization, and verification phases.

Phase	Criteria		
	Outdoor/Indoor Gamma Radiation ($\mu\text{R/hr}$) ¹	Soil Concentrations (pCi/g) ²	Indoor Radon and Thoron Concentrations ³ (WL) ⁴
1. Discovery	Background ⁵	5 ⁶	.02
2. Characterization	Background	5	.02
3. Verification	Background	5 ⁷	.03

¹Gamma radiation is measured in microrentgens per hour.

²Concentrations of radioactive elements are measured in picoCuries per gram (pCi/g) of dry soil. A picoCurie is a measure of how quickly a radioactive element is decaying.

³Combined radon and thoron concentrations.

⁴(WL) A "working level" is a measure of the energy given to lung tissue by alpha particles from radon or thoron decay products. It is closely associated with lung dose.

⁵Because gamma radiation also occurs naturally, U.S. EPA will determine naturally occurring levels of gamma radiation, called "background levels," in the West Chicago area and then measure gamma radiation at properties to see if higher levels are found. If higher levels are found, U.S. EPA will use a statistical test to determine when measurements exceed background.

⁶U.S. EPA's criteria for all three phases will be 5 pCi/g above the background levels determined by the Agency

⁷As averaged over a 100 square meter area.

Criteria Not Chosen

During its review of environmental laws and regulations, U.S. EPA found several federal and state regulations that could have been used as sources for additional ARARs. U.S. EPA concluded that while the requirements were relevant to the conditions at the site, they were not appropriate for use at the site because they would not provide any additional useful information. The federal and state regulations not

chosen as ARARs related to (1) outdoor radon and thoron concentrations, (2) radon and thoron release rates from soil, and (3) radiation doses. More detailed information on the regulations and the reasons they were not selected is contained in the document called "Action Criteria for Superfund Removal Actions, West Chicago, Illinois--Review Draft" in the information repository (see next section).

Public Meeting

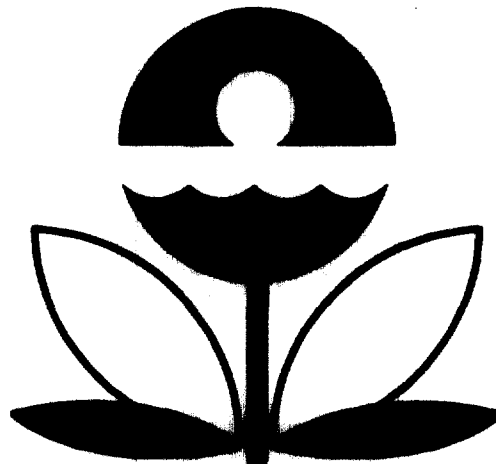
U.S. EPA is holding a public meeting regarding its criteria for cleaning up contaminated properties. U.S. EPA will give a short presentation and then answer questions from the public. For an opportunity to learn more about the criteria, the public is encouraged to attend the meeting.

Date: March 15, 1993
Time: ~~2:00 p.m.~~ 7:30 p.m.
Location: West Chicago Junior High School
238 E. Hazel
West Chicago, Illinois

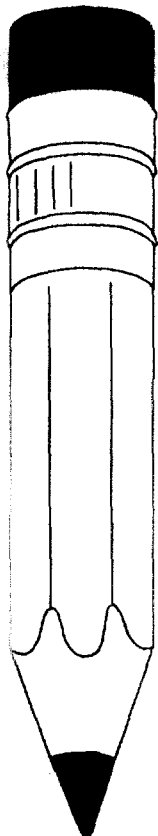
U.S. EPA is preparing to finalize the criteria after March 29, 1993, but the Agency will review any

information it receives from the public concerning its criteria before that date. Any information that you want U.S. EPA to consider should be sent to Rebecca Frey of the U.S. EPA, postmarked by March 29, 1993, at the address provided on the next page.

More public meetings will be held in the future to discuss U.S. EPA's findings and progress at the Kerr-McGee Superfund sites. U.S. EPA will be placing public notices in the weekly newspaper, *West Chicago Press*, and in the western edition of the *Daily Herald*, to announce upcoming meetings and other events. Notices and fact sheets also will be sent to those on U.S. EPA's mailing list for the Kerr-McGee Superfund sites.



Learn More About the Kerr-McGee Sites



If you are interested in reading the document that was summarized in this fact sheet, called "Action Criteria for Superfund Removal Actions, West Chicago, Illinois--Review Draft," or any other information that is prepared as part of the investigations at the Kerr-McGee Superfund sites, visit the following information repository:

West Chicago Public Library
332 East Washington Street
West Chicago, Illinois
(708) 231-1552

Hours:
Monday through Thursday 9:00 AM to 9:00 PM
Friday and Saturday 9:00 AM to 5:00 PM
Closed Sundays

For further information on this fact sheet, contact the following U.S. EPA personnel:

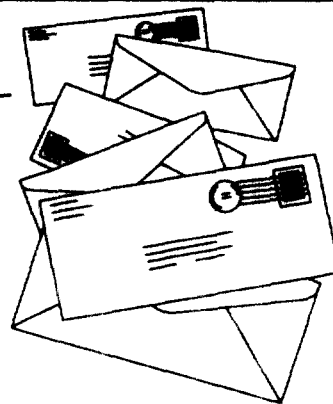
Gina Rosario
Community Relations Coordinator
Office of Public Affairs (PS-19J)
(312) 353-3207

Rebecca Frey
Remedial Project Manager
Remedial Response Branch (HSRL-6J)
(312) 886-4760

U.S. EPA - Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604

Mailing List Additions

If you did not receive this fact sheet by mail, then you are not on U.S. EPA's mailing list to receive further information about the Kerr-McGee Superfund sites. If you would like to be placed on the this list, please fill out this form and return it to Gina Rosario at the address above.



Name: _____

Address: _____

Telephone: _____

Affiliation: _____

**INSIDE: U.S. EPA Criteria for Finding and Cleaning Up
Properties Contaminated with Radioactive
Wastes from the Kerr-McGee West Chicago
Rare Earths Facility**

**U.S. EPA
Office of Public Affairs (PS-19J)
77 West Jackson Boulevard
Chicago, Illinois 60604**



Printed on recycled paper